

*The School Diversion and Environmental  
Education Law*



*School DEEL and  
Environmental Service-  
Learning—Case Studies and  
Technical Support*

*September 2005*

*Produced under contract by*

*The Acorn Group*



**S T A T E   O F   C A L I F O R N I A**

**Arnold Schwarzenegger**  
Governor

**Alan C. Lloyd, Ph.D,**  
Secretary, California Environmental Protection Agency

•

**INTEGRATED WASTE MANAGEMENT BOARD**

**Rosario Marin**  
Board Chair

**Rosalie Mulé**  
Board Member

**Cheryl Peace**  
Board Member

**Carl Washington**  
Board Member

(Vacant Position)  
Board Member

(Vacant Position)  
Board Member


•

**Mark Leary**  
Executive Director

For additional copies of this publication, contact:

Integrated Waste Management Board  
Public Affairs Office, Publications Clearinghouse (MS-6)  
1001 I Street  
P.O. Box 4025  
Sacramento, CA 95812-4025  
[www.ciwmb.ca.gov/Publications/](http://www.ciwmb.ca.gov/Publications/)  
1-800-CA-WASTE (California only) or (916) 341-6306

Publication #560-05-006

 Copies of this document originally provided by CIWMB were printed on recycled paper containing 100 percent postconsumer fiber.

Copyright © 2005 by the California Integrated Waste Management Board. All rights reserved. This publication, or parts thereof, may not be reproduced in any form without permission.

*Prepared as part of contract nos. SCS-C110 and IWM03052 (total contract amount: \$621,000, includes other services not related to this report).*

*The California Integrated Waste Management Board (CIWMB) does not discriminate on the basis of disability in access to its programs. CIWMB publications are available in accessible formats upon request by calling the Public Affairs Office at (916) 341-6300. Persons with hearing impairments can reach the CIWMB through the California Relay Service, 1-800-735-2929.*

**Join Governor Schwarzenegger to Keep California Rolling.**

Every Californian can help to reduce energy and fuel consumption. For a list of simple ways you can reduce demand and cut your energy and fuel costs, Flex Your Power and visit [www.fypower.com](http://www.fypower.com).

**Disclaimer: This publication was produced under contract with The Acorn Group. Statements and conclusions contained in this publication are those of the contractor and not necessarily those of the California Integrated Waste Management Board, its employees, or the State of California and should not be cited or quoted as official Board policy or direction.**

**The State makes no warranty, expressed or implied, and assumes no liability for the information contained in the succeeding text. Any mention of commercial products or processes shall not be construed as an endorsement of such products or processes.**

# Table of Contents

---

Acknowledgments.....	iii
Project Director .....	iii
Writing Team .....	iii
Scientific and Technical Advisors.....	iii
Introduction.....	1
Project Background .....	1
School DEEL and Environmental Service-Learning Overview .....	1
Integrated Waste Management: Section 1—Case Studies .....	3
The Athenian School .....	3
California School for the Deaf .....	4
El Rodeo Elementary School.....	5
Laytonville Elementary/Middle School .....	6
McKinley Elementary School .....	7
Monte Vista Elementary School.....	7
Monte Vista Middle School.....	8
Oak Grove Elementary School.....	9
Integrated Waste Management: Section 2—Technical Support .....	11
Integrated Waste Management: Section 3—Student Survey .....	14
Energy and Air Resources: Section 1—Case Studies .....	15
The Athenian School .....	15
Broadous Elementary School .....	16
Del Mar Elementary School .....	17
De Vargas Elementary School.....	17
Oak Grove Elementary School.....	18
Pinole Valley High School .....	19
Wawona Middle School .....	20
Energy and Air Resources: Section 2—Technical Support .....	21
Energy and Air Resources: Section 3—Student Survey .....	25
Water Resources: Section 1—Case Studies.....	26
The Athenian School .....	26
California School for the Deaf .....	27
Dover Elementary School.....	27
Monte Vista Elementary School.....	28
Oak Grove Elementary School.....	29
Salmon Creek School .....	30
San Francisco Community Alternative School .....	30
South Tahoe High School.....	31

Tenaya Middle School.....	32
Water Resources: Section 2—Technical Support.....	34
Water Resources: Section 3—Student Survey.....	36

# Acknowledgments

---

State Board of Education

California Department of Education

State Secretary for Education

## ***Project Director***

Tricia Broddrick (September 2001–March 2004)  
Office of Education and the Environment  
California Integrated Waste Management Board

Joanne Vorhies (April 2004–present)  
Office of Education and the Environment  
California Integrated Waste Management Board

## ***Writing Team***

Lori Mann, Lead Author  
Consultant

Jennifer Rigby  
Director  
The Acorn Group

Gerald A. Lieberman, Ph.D.  
Director  
State Education and Environment Roundtable

Michelle Kirk  
WestEd

Laura Powell  
Consultant

## ***Scientific and Technical Advisors***

Bill Andrews<sup>\*</sup>  
Office of Environmental Education  
California Department of Education

Rick Beall  
HMS, Inc.

Tricia Broddrick<sup>\*</sup>  
Office of Education and the Environment  
California Integrated Waste Management Board

---

<sup>\*</sup> Reflects affiliation at the time these materials were originally prepared and published in draft form.

Catherine Cardozo  
Diversion, Planning, and Local Assistance Division  
California Integrated Waste Management Board

Simon Eching  
Office of Water Use Efficiency  
Department of Water Resources

Bruce Fujimoto, P.E.  
Division of Water Quality  
State Water Resources Control Board

Suzanne Garfield-Jones  
California Energy Commission

Marshall Graham  
Diversion, Planning, and Local Assistance Division  
California Integrated Waste Management Board

Terri Gray  
Diversion, Planning, and Local Assistance Division  
California Integrated Waste Management Board

Jeff Hohensee  
TreePeople

Claudie Kiti\*  
State and Consumer Services Agency

Pauline Lawrence  
Office of Education and the Environment  
California Integrated Waste Management Board

Tom Mays  
Office of Public Affairs  
State Water Resources Control Board

Rich Mills  
Division of Financial Assistance  
State Water Resources Control Board

Cara Morgan  
Diversion, Planning, and Local Assistance Division  
California Integrated Waste Management Board

Claudia Orlando  
Energy Office  
California Energy Commission

Tavia Pagan  
Office of Education and the Environment  
California Integrated Waste Management Board

---

\* Reflects affiliation at the time these materials were originally prepared and published in draft form.

Dana Papke  
Green Building Program  
California Integrated Waste Management Board

Don Peri<sup>\*</sup>  
Office of Education and the Environment  
California Integrated Waste Management Board

Thomas Phillips  
Research Division  
Air Resources Board

Martin Rigby, Ph.D.<sup>\*</sup>  
Consultant on Water Resources

Art Sussman, PhD.  
WestEd

Valorie Shatynski  
Office of Education and the Environment  
California Integrated Waste Management Board

Patrick Schiavo  
Diversion, Planning, and Local Assistance Division  
California Integrated Waste Management Board

Rachelle Steen  
Office of Education and the Environment  
California Integrated Waste Management Board

Dave Todd  
Office of Water Use Efficiency  
Department of Water Resources

Carolyn Tucker  
Office of Water Education  
Department of Water Resources

Rebecca Williams<sup>\*</sup>  
Office of Education and the Environment  
California Integrated Waste Management Board

Ed Wong  
Office of the Ombudsman  
Air Resources Board

---

<sup>\*</sup> Reflects affiliation at the time these materials were originally prepared and published in draft form.

# Introduction

---

## ***Project Background***

The School Diversion and Environmental Education Law (School DEEL) was signed into law in September 2001 (SB373, Torlakson, Chapter 926, Statutes of 2001). The law created a series of integrated waste management and education mandates for the California Integrated Waste Management Board (CIWMB). The legislation is intended to increase the presence of resource management programs, such as waste reduction, recycling, and composting on school district campuses statewide.

The School DEEL calls for developing, implementing, and adopting a plan for elementary and secondary schools in the state that includes the following elements:

- Coordinate instructional resources and strategies for providing active pupil participation with on-site conservation efforts.
- Promote service-learning opportunities between schools and local communities.
- Assess the impact to participating pupils on student achievement and resource conservation.
- Create models and school waste reduction tools for schools, school districts, county offices, and local agencies.
- Establish an Environmental Ambassador Pilot Program and a unified education strategy (UES).
- Provide grants to school districts to implement programs teaching source reduction, recycling, and composting.
- Identify and promote use of recycled-content materials and environmentally preferable products in the construction and modernization of public school facilities.
- Evaluate the effects of school waste reduction plans and other resource conservation efforts in the state's schools.

The School DEEL specifies that “Every school district and school site in this state will be encouraged to implement source reduction, recycling, and composting programs that ... (A) Reduce waste and conserve resources...(B) Provide pupils with a ‘hands-on’ learning experience.” (Public Resources Code [PRC] section 42630) The legislation calls for the development of “service-learning partnerships, in which schools and communities work to provide real world experiences to pupils in areas of the environment and resource conservation, including education projects developed and implemented by pupils to encourage others to utilize integrated waste management concepts.” (Education Code section 51226.4)

## ***School DEEL and Environmental Service-Learning Overview***

This manual contains supplementary materials originally designed to assist Environmental Ambassadors and UES schools in planning and implementing the campus-based needs assessments and service-learning components of the School DEEL program. Now that the School DEEL program has concluded, this document can provide other interested schools with the information necessary to design and implement comparable resource management programs on their own campuses.



The companion is divided into three topics: integrated waste management, energy and air resources, and water resources. There are three sections within each topic:

Section 1: Presents case studies that serve as successful examples of campus-based service-learning related to each topic area.

Section 2: Provides sources of technical support for carrying out needs assessments and service-learning projects. It also lists organizations, agencies, websites, and other resources that can answer questions and offer local assistance.

Section 3: Includes student surveys that have been developed and tested for use at the sixth-grade level. These surveys can help assess students' knowledge about waste, energy and air, and water resources.

# Integrated Waste Management:

## Section 1—Case Studies

---

### ***The Athenian School***

#### ***Danville, California***

<i>County:</i>	<i>Contra Costa</i>
<i>District:</i>	<i>San Ramon Valley Unified</i>
<i>Grades:</i>	<i>6–12</i>
<i>Enrollment:</i>	<i>512</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

The Athenian School is a private preparatory school (grades 6–12) at the base of Mt. Diablo, about an hour's drive east of San Francisco. Environmental conservation is one of the five pillars of the school. Community service, both on- and off-campus, is considered an important component of the curriculum.

Each year, students in the twelfth grade environmental science classes work to identify environmental problems on campus, propose solutions, present those solutions to the school's board of trustees, and plan and implement several of the projects that result from this process. Once a project is approved, the students have the responsibility for planning and making decisions. To date, the students have saved the school roughly \$20,000 per year.

During the 2001–02 school year, students examined the recycling program at Athenian and recommended a series of changes to improve the existing program. After conducting a survey of school trash cans, they determined that at least 50 percent of the contents of the cans was recyclable, a fact inconsistent with school philosophy and costing the school money.

They identified three problems: lack of recycling bins; limited knowledge about recycling; and an ineffective process for collecting recyclable materials. The students identified scarcity, poor placement, and lack of uniformity of available recycling bins as the most significant issues.

The students proposed a wide variety of ideas, many of which were implemented by the 2002–03 senior class. Their proposals included:

1. Placing bright blue, clearly identified polyethylene recycling bins wherever there are trash cans. The students determined the number, size, and cost of the bins and made recommendations for funding the purchase.
2. Labeling the recycling bins with uniform signs clearly listing what can be placed in them, along with placing signs promoting the importance of recycling on all trashcans.
3. Making monthly announcements, by the freshman recycling group, to create schoolwide awareness of the recycling program.
4. Increasing the number of students in the freshman recycling group and arranging for the group to collect recyclables during their weekly community-service period.
5. Appointing two student supervisors (one junior and one senior) to oversee collection of recycling in upper-school classrooms.
6. Confirming that office staff empty their recycling into central bins in the office buildings.

7. Recommending two options for collection of recyclables from the school's common areas.
- These waste management practices remain in place today.

**California School for the Deaf**  
**Fremont, California**

*County:* Alameda  
*District:* State Special School  
*Grades:* K-12  
*Enrollment:* 441  
*Population Status:* Mid-size city

Students at the California School for the Deaf in Fremont set an annual tree-saving goal. To meet—or more often exceed—their goal, they recycle paper. Working with the Alameda County Office of Education Service-Learning program, they've modeled their recycling program after municipal curbside collection programs. Each Thursday, students set out their bins. They then count the bins' contents and convert their data to an estimated number of trees saved. School custodians collect the bins and empty them into recycling dumpsters. Students estimate they save 430 trees per year.

To extend their waste diversion efforts, the school initiated a vermicomposting program (composting with earthworms) for their cafeteria wastes. The school is residential, and the two cafeterias serve 1,000 people per day. The Alameda County Waste Management Authority provided 50,000 red worms and specially designed bins to start the vermicomposting project. The worms started eating in fall 2002 and now consume about 60 pounds of vegetables, fruit, and bread daily.

Compost generated by the program is used to fertilize the school's Environmental Farm, which is used by classes as varied as biology, wood shop, English, building technology, and chemistry. The Environmental Farm is also the hub for environmental science classes, which are taught as service-learning classes with the themes of hunger, farms, and homelessness. Students are involved in all aspects of planning, developing timelines, implementing plans, and harvesting.

Coming full circle, vegetables grown on the Environmental Farm are now sold back to the school cafeteria at low cost, saving money and providing fresh, organic produce for the students and staff.

To address the remaining "R" in the Reduce, Reuse, Recycle continuum, students have started a clothing donation program and are finding second uses for their wearable used clothes.

## ***El Rodeo Elementary School***

### ***Beverly Hills, California***

<i>County:</i>	<i>Los Angeles</i>
<i>District:</i>	<i>Beverly Hills Unified</i>
<i>Grades:</i>	<i>K–8</i>
<i>Enrollment:</i>	<i>765</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

The Battle of the Schools Waste Competition had begun, and seventh- and eighth-grade students at El Rodeo Elementary School rose to the challenge. Presented by the County of Los Angeles' Generation Earth program in cooperation with a local radio station, schools throughout the county challenge each other to see which campus can make the greatest strides in improving their environment. Many schools are able to reduce the amount of trash they create, increase the amount of recycling they do, and save money in the process. The winning school is announced throughout the county and gets a lunchtime concert.

As part of an elective "Super Science Recycling Class," El Rodeo students began by conducting an on-campus waste audit to assess the school's waste stream. Students kept statistical data, graphed the data, and reported to their classmates. After analyzing their results, they identified three primary objectives to: reduce waste, reduce contamination in recycling bins, and recycle more paper throughout the school.

Next, students looked for ways to improve current conditions. They determined that every classroom needed paper recycling bins, and a reliable system for collecting from those bins was also needed. The students realized they also needed an awareness and advertising campaign for educating the school population about contamination in the recycling bins. Students worked with the custodial staff, wrote speeches, monitored the disposal bins, and measured what went into each bin. With guidance and technical assistance from their teacher and Generation Earth staff, the seventh and eighth graders planned and implemented their waste reduction program—and won First Place in the 2003 Battle of the Schools Waste Competition!

In recent years, students enrolled in the Super Science Recycling elective have continued to expand the school's recycling efforts to include inkjet cartridges, laser printer toner cartridges, batteries, and six-pack rings. The entire school participates in collecting recyclables, and the seventh- and eighth-graders in the elective class inventory and package the materials for processing. The money raised through their efforts is donated to the school's PTA and to other nonprofit groups selected by the students as part of their service-learning project.

## **Laytonville Elementary/Middle School**

### **Laytonville, California**

*County:* Mendocino  
*District:* Laytonville Unified  
*Grades:* K–8  
*Enrollment:* 203  
*Population Status:* Rural area

After two years of experimenting with small-scale worm composting of cafeteria food wastes, the student council at Laytonville Elementary/Middle School voted in 1991 to use their funds to pilot a large-scale vermicomposting project. The school used this system to compost some paper lunch sacks and all cafeteria food waste except meat, milk, and cheese.

The students constructed the specially designed worm bins themselves, keeping them just 12 inches deep so even small children could turn the compost pile. Turning maintains the aerobic activity in the bins and diminishes foul odors in the pile.

The bedding for the worms came from the classrooms and added to the efficiency of waste diversion at Laytonville. Students separated waste paper into separate boxes in the classroom. One day each week, students from a fifth grade class used wheelbarrows to carry the paper to the “shred shed,” where it was further sorted. Lunch bags, colored construction paper, and newsprint went first to the electric shredder and then to the worms; the glossy and white paper went to the recycling center.

Students managed the entire program. They monitored cafeteria waste, where vegetable waste was separated from meat waste and other recyclables. Students picked up the food to be composted on a daily basis. They weighed the waste and charted the data on a large bar graph posted in the cafeteria. In 2002, the school averaged about 20 pounds of food waste per day, down from an average of 36 pounds per day two years before.

To maintain the health of each bin, students also monitored and recorded information about the location of buried food, worm populations, pH, moisture, and other variables. Students then made adjustments to the bins based on their observations and analysis.

The vermicompost was harvested every two to three months and used to fertilize the school’s extensive educational garden. Three interested teachers and their classes started the garden at Laytonville Elementary/Middle School in September 1987 with three raised beds. Today, it hosts 30 raised beds and serves 14 teachers and their classes. Students grow produce and sell it to the school lunch program. The Middle School Market is open daily in front of the school; when parents pick up their children after school, they can purchase fresh vegetables for dinner. Some students grow food for their families at the garden and are able to take that produce home with them. The school donates any extra produce to the community.

The vermicomposting project ended in 2003 when a grant funds ran out. In its last year, the school vermicomposted 2,500 pounds of cafeteria food waste and saved the district \$6,000 in dumpster fees. Through the Garden and Recycling Project, Laytonville Unified School District reduced its waste by 60 to 80 percent and no longer needed to purchase fertilizer.

The garden program continues today, supported with a nutrition grant and federal work ability project grant. Through the career-focused federal project, students work in the kitchen, where they compost kitchen scraps. The compost is still used on the school garden.

## **McKinley Elementary School**

### **San Leandro, California**

*County:* Alameda  
*District:* San Leandro Unified  
*Grades:* K–5  
*Enrollment:* 496  
*Population Status:* Mid-size city

After visiting Alameda County's largest transfer station on a school field trip, third graders at McKinley Elementary School were motivated to explore ways to reduce waste on their campus. Working with second-, third-, and fourth-grade students, they audited their campus to find where waste was generated. The students recorded their findings and created charts to show the amounts and types of waste produced in classrooms, lunchrooms, and other areas on campus.

They formed a Recycling Ambassador team and set a goal to reduce school-wide waste between 30 and 50 percent over the course of the year. The classes brainstormed ways to accomplish their goal and developed suggestions for implementing changes. All students in the designated classrooms were part of the decision-making and planning process.

Focusing on classroom waste, the Recycling Ambassadors distributed recycling bins to every classroom and made surprise inspections twice a week. Classes with no recyclables in the trash cans were rewarded with prizes and recognition over the public address system, inspiring other classes to increase their participation. McKinley also held a Reuse Extravaganza to help educate the community about the benefits of recycling.

The Alameda County Office of Education Service-Learning program and the Alameda County Waste Management Authority provided assistance and support for the project. The students used the award money they received to purchase books on conservation issues for the school library.

Recycling practices are still in place today in every classroom, and most teachers integrate the recycling program into their curriculum. The fourth- and fifth-graders continue to visit the local recycling center to learn how what they do at school affects their community.

## **Monte Vista Elementary School**

### **Santa Barbara, California**

*County:* Santa Barbara  
*District:* Hope Elementary  
*Grades:* K–6  
*Enrollment:* 496  
*Population Status:* Mid-size city

Several years ago, the Monte Vista Student Council helped with an assembly program developed by several community groups in the Santa Barbara area. The program was about recycling, and it launched a continuing campaign that has resulted in diverting from the waste stream four to six cubic yards of commingled recyclables each week.

The school works with Marborg Industries, the local waste collection company, on the collection of commingled recyclables. Every classroom has a blue recycling basket alongside a matching-size trash can. Students dump the blue containers into larger, centrally located containers, which are wheeled out, with adult supervision, to the dumpster for weekly pick-up by Marborg.

A local dentist volunteers time once a week to help the school with its vermicomposting system. Food is collected in containers on a wagon in the lunch area once a week, and then carted to the worm farm. The custodians also contribute by collecting used paper toweling from school restrooms and adding it to the vermicomposting process along with leaves from the campus. The compost is used on the school nature trail and gardens. Some is also bagged and sold at the school's weekly farmer's market.

Each year, students present a school assembly to reintroduce recycling and worm composting. They also make and post reminder signs throughout the campus.

### **Monte Vista Middle School**

#### **Tracy, California**

County:	<i>San Joaquin</i>
District:	<i>Tracy Joint Unified</i>
Grades:	<i>6–8</i>
Enrollment:	<i>968</i>
Population Status:	<i>Urban fringe of a mid-size city</i>

The seventh-grade students at Monte Vista Middle School gathered to identify different problems on campus. Emerging from this discussion was the fact that the school threw away two 30-gallon trash cans of unsold food and two to three pounds of paper in each classroom every day. During baseball season, trash on campus increases.

The students decided to tackle three categories of waste: food, newspaper, and paper. They divided into groups and researched possible ways to recycle their assigned waste. They discussed the most practical methods, made recommendations, and undertook three projects to reduce waste on campus.

The students constructed worm bins and started a vermicomposting system to address campus food waste. They set out special garbage cans in the kitchen to collect unsold food. At the end of the lunch period, designated students collected, sorted (worm food, other food, trash), weighed, and recorded data for the waste. The students feed the worms daily but only the amount they are capable of handling; the remaining waste is sent to a composting facility. The compost is sold to provide sustainable funding for the school's various recycling projects.

The group responsible for recycling newspaper decided to reuse the newsprint by making decomposing starter pots for raising new plants and cuttings. Once the plants have sprouted, the entire pot can be planted in the ground, where the newspaper will eventually decompose.

To increase paper recycling and reuse, the third group of students collected waste paper from the classrooms. Under adult supervision, they used blenders to grind the paper into pulp, which they then mixed with seeds. After draining the pulp, they flattened and dried it to produce seed-laden paper, which they decorated and made into greeting cards.

Putting all of their creations together, the students created plant starter kits containing bags of compost, newspaper pots, and greeting cards, along with informational pamphlets. Students distributed these starter kits throughout the community to promote the importance of recycling.

Recently, the school expanded to an even more comprehensive campus-wide recycling program. Each classroom now has a single recycling container for aluminum glass, plastic containers, newspapers, and regular paper. The seventh graders collect the bins and bring them back to class, where they separate and bag the materials to take to the recycling facility. The money collected from recycling is put into the student account and used to buy prizes for accelerated readers and other materials.

## ***Oak Grove Elementary School***

### ***Graton, California***

<i>County:</i>	<i>Sonoma</i>
<i>District:</i>	<i>Oak Grove Union Elementary</i>
<i>Grades:</i>	<i>K–5</i>
<i>Enrollment:</i>	<i>263</i>
<i>Population Status:</i>	<i>Urban fringe of a mid-size city</i>

Oak Grove School is located in rural Sonoma County on a five-acre parcel. Originally established in 1854, the current buildings were constructed in 1954. The school community has made a commitment to “use all things entrusted to us with care, not to use more than we need, and to pass on to the future everything that we can.”

In 1991, the school custodian led the development of a recycling and composting program to save money spent on trash collection. Since then, the school has reduced its waste output nearly 90 percent, from 8 cubic yards per week to 1 cubic yard per week. Cardboard was the first resource recycled, followed by mixed paper, then cans, bottles, plastic containers, and other commonly recycled items. During the 1991–92 school year, the custodian and community members built vermicompost bins to handle paper waste, weeds, prunings, and other organic materials produced on campus.

Now, each classroom has four numerically and color-coded bins, one each for: mixed paper (white and colored paper, newspaper, construction paper, envelopes, magazines); compostable materials (paper towels, plates, cups, food, plant material, dirty paper, tissues); mixed recyclables (bottles, cans, aluminum foil, plastic bottles, plastic bags, cardboard, brown paper bags); and non-recyclable waste. During recess or lunch, student volunteers empty these containers into larger coded bins in the hallways, which are in turn emptied by custodians into a series of specially organized dumpsters, storage areas, and the compost pile.

Recovery stations in offices, bathrooms, on the playground, and anywhere else trash cans would normally be found are coded for compost, mixed recyclables, and non-recyclable waste. Where appropriate, there is also a container for mixed paper. The custodial staff sorts and empties these containers daily. Paper towels are collected daily in the bathrooms and taken to the vermicomposting area by the custodian.

The district’s purchasing office supports these efforts through its purchasing policies. For example, the district only buys unbleached towels to help reduce the amount of dioxin produced in manufacturing the towels used at the school.



Students separate their lunch trash into containers for food scraps, milk cartons and juice boxes, compost, plastic bags, aluminum, plastic bottles, and brown paper bags. Third- and fourth-grade volunteers monitor these containers. They also rinse and open the milk cartons and juice boxes. They also give the food scraps to a local pig farmer. The school has used the money generated by its recycling program to purchase biodegradable straws and cutlery for the lunch program.

To reduce waste, the students, teachers, and custodians collect uneaten, unopened packages of food and donate them to a food pantry rather than throwing them away. Waste reduction is further enhanced through the school's many small vegetable gardens, which produce low-cost vegetables for the school salad bar. The school community has worked together to plant an orchard, which they expect to contribute fruit and walnuts to the salad bar within the next few years.

To close the recycling loop, the school uses recycled copy paper and toilet paper. Recent staff efforts have focused on working with the company that provides school lunches to substantially reduce the amount of packaging.

# Integrated Waste Management:

## Section 2—Technical Support

---

### **Alameda County Office of Education**

#### ***Service-Learning Waste Reduction Project***

[www.alameda-coe.k12.ca.us/acoe\\_docs\\_candi/waste\\_reduction\\_brochure.pdf](http://www.alameda-coe.k12.ca.us/acoe_docs_candi/waste_reduction_brochure.pdf)

Service-learning specialist provides support for waste-reduction service-learning projects.

### **Alameda County Waste Management Authority**

[www.stopwaste.org/](http://www.stopwaste.org/)

### **Composting hotline: (800) 444-SOIL**

Regional resources and information, including curriculum, technical support. Master composters available to assist schools. Also includes information on worm composting

([www.stopwasate.org/wormcomp.htm](http://www.stopwasate.org/wormcomp.htm)) and tips for reducing waste at school

([www.stopwaste.org/home/index.asp?page=448](http://www.stopwaste.org/home/index.asp?page=448)).

### **California Department of Conservation (Resources Agency)**

#### **Division of Recycling, Community Assistance Section**

**(800) RECYCLE or (916) 322-0613**

[www.conservation.ca.gov/](http://www.conservation.ca.gov/)

Administers the California “Bottle Bill.” Can provide localized information about recycling and may be able to provide support in setting up a recycling program.

### **California Department of Toxic Substances Control (Cal/EPA)**

[www.dtsc.ca.gov/](http://www.dtsc.ca.gov/)

Responsible for regulating hazardous waste, including cleanup of hazardous substances sites. Site contains technical information on hazardous wastes. Publications include *No Waste Anthology*, *Hazard House Workbook*.

### **California Environmental Protection Agency (Cal/EPA)**

[www.calepa.ca.gov](http://www.calepa.ca.gov)

The California Environmental Protection Agency includes six boards, departments, and offices that work on the protection of human health and the environment. Cal/EPA’s mission is to restore, protect, and enhance the environment, and to ensure public health, environmental quality, and economic vitality.

### **California Integrated Waste Management Board (Cal/EPA)**

[www.ciwmb.ca.gov](http://www.ciwmb.ca.gov)

Regulates the processing and disposal of solid waste and landfills. Develops recycling markets. Gives school districts assistance in establishing source reduction and recycling programs.

Office of Education and the Environment (OEE) ([www.ciwmb.ca.gov/Schools/](http://www.ciwmb.ca.gov/Schools/)) coordinates efforts to implement the provisions of the School Diversion and Environmental Education Law (School DEEL) (Senate Bill 373—Torlakson, Chapter 926, Statutes of 2001). In addition, OEE works with local agencies to promote waste management education in local schools and informal settings, such as science centers and museums.

Office of Local Assistance (OLA) ([www.ciwmb.ca.gov/OLA/](http://www.ciwmb.ca.gov/OLA/)) offers regional contacts. Publications include *A District-wide Approach to Recycling: A Guide for School Districts* (1994), a comprehensive guide to establishing school district recycling programs, and *Seeing Green Through Waste Prevention: A Guide for School Districts* (1999), which illustrates waste prevention practices that schools and school districts have found effective in reducing waste and cutting costs. Can advise on student needs assessments. Worm information and resources at [www.ciwmb.ca.gov/Organics/Worms/default.htm](http://www.ciwmb.ca.gov/Organics/Worms/default.htm).

California Materials Exchange (CalMAX) ([www.ciwmb.ca.gov/CalMAX/default.asp](http://www.ciwmb.ca.gov/CalMAX/default.asp)) is a free service designed to help businesses find markets for nonhazardous materials they have traditionally discarded. CalMAX helps businesses, industries, and institutions save resources and money.

KidMAX ([www.ciwmb.ca.gov/CalMAX/Kidmax.htm](http://www.ciwmb.ca.gov/CalMAX/Kidmax.htm)) is a materials exchange for schools. KidMAX provides a free source of used materials to California schools. Users search by region for available used material or submit a request.

### **Certified Used Motor Oil and Filter Collection Centers (800) CLEAN-UP**

Locator service for used motor oil recycling.

### **Earth's 911** [www.earth911.org/](http://www.earth911.org/)

ZIP code entry returns comprehensive links and information about county-level resources related to waste and waste management.

### **Government of New Brunswick Backyard Magic: The Composting Handbook** [www.gnf.ca/0009/0372/0003/0010-e.asp](http://www.gnf.ca/0009/0372/0003/0010-e.asp)

Background information, instructions, and troubleshooting tips related to composting.

### **How to Compost.org: Your Compost Resource** [www.howtocompost.org](http://www.howtocompost.org)

Technical information on composting, links to composting resources, suppliers, and classroom resources.

### ***How to Start a Beverage Container Recycling Program at School*** **California Department of Conservation (Resources Agency)** **Division of Recycling—Education Section** **Sacramento, California** [www.conservation.ca.gov/](http://www.conservation.ca.gov/)

Publication can be downloaded at  
[www.conservation.ca.gov/DOR/rre/kids/Ed\\_Images/images/RecycleProgram.pdf](http://www.conservation.ca.gov/DOR/rre/kids/Ed_Images/images/RecycleProgram.pdf)

Brochure briefly describes ten steps to setting up a campus beverage recycling program. Captures the basics, but does not provide much detail, and additional material may be needed. Includes contact information for the Department of Conservation's Community Assistance Section and provides instructions for obtaining recycling emblem decals. A list of recycling activities and resources offered free of charge for teachers is provided.

**The Master Composter**

[www.mastercomposter.com](http://www.mastercomposter.com)

Background information, instructions, supplies and equipment, online discussion group, teacher resources, and many links to selected compost-related websites.

**Planet Natural**

[www.planetnatural.com/composting.html](http://www.planetnatural.com/composting.html)

Commercial sales of composting products.

***School Recycling Guide: Setting Up Solid Waste Recycling Programs in Schools*  
Keep America Beautiful, Inc.**

[www.kab.org/](http://www.kab.org/)

A fill-in-the-blanks guide that lays out a clear and practical approach to assessing the current trash situation on a school campus and setting up an appropriate recycling program for the school and/or community. Worksheets guide you through the process of creating a recycling program responsive to any particular set of circumstances. Includes tips for successful programs and case study examples.

**United States Environmental Protection Agency**

[www.epa.gov/](http://www.epa.gov/)

Extensive publications, links, education materials on all aspects of environment. An extensive Where You Live section ([www.epa.gov/epahome/whereyoulive.htm](http://www.epa.gov/epahome/whereyoulive.htm)) includes online environmental information about local communities, such as interactive maps, current forecasts, geographic statistics, and links to information on environmental issues like air and water quality, Superfund sites, and impaired water. Also links to local services working to protect your local environment. Search Your Community ([www.epa.gov/epahome/commsearch.htm](http://www.epa.gov/epahome/commsearch.htm)) enables searches by zip code to four extensive environmental databases. Ideas for service-learning projects on [www.epa.gov/teachers/community\\_service\\_projects.htm](http://www.epa.gov/teachers/community_service_projects.htm). Virtual house tour ([www.epa.gov/kidshometour](http://www.epa.gov/kidshometour)) shows where potentially harmful chemicals can be found. Designed for student use.

**VegWeb Introduction to Composting**

[www.vegweb.com/composting](http://www.vegweb.com/composting)

Includes instructions, background information, and list of composting demonstration sites.

**Waste-Free Lunches**

[www.wastefreelunches.org/](http://www.wastefreelunches.org/)

Santa Cruz school provides information on waste-free lunch programs, success stories, and how to get started.

**Worm Digest**

[www.wormdigest.org](http://www.wormdigest.org)

Quarterly newsletter with information and resources related to vermicomposting.

# Integrated Waste Management:

## Section 3—Student Survey

---

**Directions to the interviewer: Do not read the answers to the student, except for question 8. Just mark the student's answers on the sheet.**

We're taking a survey for our class. May I ask you some questions?

What is your name? \_\_\_\_\_

What grade are you in? \_\_\_\_\_

**1. What part of the school produces the most trash?**

- ☐ Landscaping (green waste).
- ☐ Cafeteria (food waste).
- ☐ Classrooms and office (solid waste).
- ☐ \_\_\_\_\_

**2. Where does most of our trash go when it leaves the school?**

- ☐ Dump or landfill.
- ☐ Incinerator.
- ☐ Ocean.
- ☐ \_\_\_\_\_

**3. Does our school have a recycling program?**

- ☐ Yes.            ☐ No.

**4. Can aluminum cans be recycled at school?**

- ☐ Yes.            ☐ No.

**5. Can the school lunch trays be recycled or reused?**

- ☐ Yes.            ☐ No.

**6. How can leftover food be recycled?**

- ☐ Composting.
- ☐ I don't know.
- ☐ \_\_\_\_\_

**7. What do you use to carry your lunch to school?**

- ☐ I don't bring a lunch to school.
- ☐ Lunch box or cooler.
- ☐ Paper bag.
- ☐ \_\_\_\_\_

**8. I'm going to read you a list of things in a classroom. Tell me if they could be recycled.**

*Directions to the interviewer: Check each "yes" answer.*

- ☐ White paper.
- ☐ Mixed paper (like construction paper or magazines).
- ☐ Newspaper.
- ☐ Cardboard.
- ☐ Plastics (if labeled PET and HDPE or 1 and 2)\_\_\_\_\_.

**9. Do you recycle anything at school?**

- ☐ Yes.            ☐ No.

**10. What do you recycle at school?**

*Directions to the interviewer: Check all answers given.*

- ☐ Glass bottles.
- ☐ Uneaten food.
- ☐ Paper wrappers.
- ☐ Foil wrappers.
- ☐ Writing paper.
- ☐ Aluminum cans.

**11. Do you recycle as much as you can at school?**

- ☐ Yes.            ☐ No.

**12. Does the school need more recycling containers?**

- ☐ Yes.            ☐ No.

**Thank you for your time.**

# Energy and Air Resources:

## Section 1—Case Studies

---

### ***The Athenian School***

#### ***Danville (Contra Costa County)***

<i>County:</i>	<i>Contra Costa</i>
<i>District:</i>	<i>San Ramon Valley Unified</i>
<i>Grades:</i>	<i>6–12</i>
<i>Enrollment:</i>	<i>512</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

The Athenian School is a private preparatory school (grades 6–12) at the base of Mt. Diablo about an hour's drive east of San Francisco. Environmental conservation is one of the five pillars of the school. Community service, both on- and off-campus, is considered an important component of the curriculum.

Each year, students in the 12th grade environmental science classes work to identify environmental problems on campus, propose solutions, present those solutions to the school's board of trustees, and plan and implement several of the projects that result from this process. Once a project is approved, the students are responsible for planning and making decisions. To date, the students have saved the school roughly \$20,000 per year.

The 2002 environmental science class worked under the supervision of a representative of Pacific Gas and Electric Company (PG&E), the local utility company, to conduct a campus energy audit. Lighting emerged as the leading issue; outdated systems and inefficient use in both the upper and middle schools were wasting electricity. The class also visited the Pacific Energy Center in San Francisco where students received instruction on conducting energy audits and learned about options for energy efficiency.

The students assessed classroom energy use based on the type of fixtures (T8 versus the less efficient T12 fluorescent tubes) and average use while occupied. Their comparisons of different classrooms suggested that behavior patterns, rather than the amount of natural light or the type of classes, were responsible for most differences in energy consumption.

They also assessed the use of lighting in the administrative offices and found that it was inconsistent and sometimes wasteful. Inefficient overhead fixtures, use of personal halogen and incandescent lamps, and overuse appeared to be the primary contributors to the problem.

The students also observed wasteful practices in lighting of the gymnasium as well as off-hours floodlighting of outdoor fields and lawns (the campus is residential and requires some nighttime security lighting).

Following their assessment of the situation, the students worked with consultants to make recommendations that included: replacing magnetic ballasts with electronic ones; eliminating the use of halogen and incandescent lamps by switching to compact fluorescent bulbs where extra desk lighting was required; using natural lighting to the maximum extent possible; encouraging office staff, faculty, and students to turn lights off when leaving a room; and installing motion detection sensor switches for gymnasium and outdoor lighting.

## ***Broadous Elementary School***

### ***Pacoima, California***

County:	Los Angeles
District:	Los Angeles Unified
Grades:	K–5
Enrollment:	1,036
Population Status:	Large city

In 2002–2003, in partnership with TreePeople (a nonprofit community organization) and the Los Angeles Department of Water and Power’s *Cool Schools* program, students at Broadous Elementary School in Pacoima helped to redesign their campus to reduce the heat island effect, lower energy consumption, and reduce stormwater runoff. Students, teachers, administrators, and community members worked together as part of a Green Team to bring the project to fruition.

TreePeople worked with the school’s Green Team to help them develop the comprehensive program, decide on target dates for training and tree planting and identify possible contributions from the community.

TreePeople introduced to the teachers the *Schoolyard Explorers* curriculum, which is aligned to California’s academic standards in math, science, language arts, and social sciences. This curriculum specifically is intended provide students the opportunity to learn about the environmental conditions of their campus and how they can take on the task of improving their school environment.

Teachers implemented the curriculum in five thematically interconnected lessons. Students first learned the benefits of trees: oxygen production, air pollutant filtration, stormwater reduction through trapping and filtering rainwater, and reduction in energy use by cooling buildings, air-conditioning units, and the surrounding pavement. Students discovered at this point how trees might benefit their own campus and chose to support the principal’s desire to improve the campus.

Next, students explored the campus watershed, mapping problem areas and learning how environmental conditions on campus might be improved by planting trees. They explored different trees types (size, shape, canopy) and decided which trees best served their needs. Finally, students made design recommendations. The project culminated as the Green Team involved the entire school and the community in locating and planting trees in accord with student designs.

All teachers and students were involved and 230 trees were planted on the campus and in the surrounding neighborhood. Each class has adopted a tree, and students will continue to observe the benefits of their service-learning.

The project has benefited the school by reducing energy use and stormwater runoff. Runoff from the campus is still monitored by the Los Angeles Department of Water and Power and the landscape enhancements remain in place.

## ***Del Mar Elementary School***

### ***Morro Bay, California***

*County: San Luis Obispo*  
*District: San Luis Coastal Unified*  
*Grades: K–6*  
*Enrollment: 456*  
*Population Status: Urban fringe of a mid-size city*

In an effort to conserve energy, educate students about alternative lighting sources, and engage students in research on light measurements in the classroom, Del Mar Elementary School in Morro Bay installed six 21-inch light-gathering tubular skylights in five classrooms. These skylights redirect sunlight and provide full-spectrum light to a 400-square-foot area; each classroom is about 928 square feet.

Prior to installing these fixtures, students used a light meter to measure the light in the classrooms with the fluorescent lights on. They established baseline data and then made comparable measurements with the skylights in place. There was an overall sustained light increase of 25 percent. Students used detailed worksheets to record and analyze the data. The teachers have now integrated studies of alternative lighting sources into their classroom curriculum.

Since May 2002 when the tubes were installed, the lights in one of the classrooms have been used just twice, with one of those being at night for Open House. In the classrooms where students and teachers were involved with the skylight installation, students continue to opt for natural daylighting and the fluorescent lights are used only sparingly if at all.

## ***De Vargas Elementary School***

### ***San Jose, California***

*County: Santa Clara*  
*District: Cupertino Union*  
*Grades: K–6*  
*Enrollment: 504*  
*Population Status: Large city*

In 2002-2003, students practiced leadership skills by participating in the Energy Patrol at De Vargas Elementary School in San Jose. The program succeeded in reducing the school's energy costs by one-third, about \$1,000 per month. Since then, this simple program has been adopted at every school in the Cupertino Union School District.

The original Energy Patrol was made up of 20 students in the fourth, fifth, and sixth grades. Four students were on duty each day and started by collecting their supplies in the school office. Working in teams of two, they checked each classroom, the office areas, and storerooms at recess, lunch, and after school. When lights were found on, students turned them off. They recorded whose lights were on or off, put reminder notices on light switches, and then returned their supplies to the office. After a little practice, the students could keep their rounds of the school to about five minutes.



To provide recognition for the students, the school purchased four jackets and got photo ID tags that the participating students wore while on duty. The teachers' only responsibility in this effort was to recommend students who could be trusted with keys to the buildings and would need little supervision.

After several months of operation, the Energy Patrol saw the results of their work—the lights were almost never left on. The patrol adjusted the schedule when they found they needed only periodic spot checks. Eventually, the team added new tasks including checking on whether shades were opened or closed at appropriate times and checking thermostat settings.

Students initiated several additional energy-saving activities such as creating a bulletin board on energy conservation, posting “Save Energy” signs on light switches and visiting the local utility to learn more about conservation. The District Office also listened when the students performed an air flow study and sent in their results—leading to the installation of many new thermostats and some improvements to the heating system.

### ***Oak Grove Elementary School***

#### ***Graton, California***

<i>County:</i>	<i>Sonoma</i>
<i>District:</i>	<i>Oak Grove Union Elementary</i>
<i>Grades:</i>	<i>K–5</i>
<i>Enrollment:</i>	<i>263</i>
<i>Population Status:</i>	<i>Urban fringe of a mid-size city</i>

Oak Grove School is located in rural Sonoma County on a five-acre parcel. Originally established in 1854, the current buildings were constructed in 1954. The school community has made a commitment to “use all things entrusted to us with care, not to use more than we need, and to pass on to the future everything that we can.”

In addition to an extensive recycling program, Oak Grove Elementary School has “gone green” in the area of energy. In order to conserve electricity, the administration converted all of the school’s magnetic lighting ballasts to more efficient electronic ballasts. They were also able to reduce the number of fluorescent lighting tubes by half, with resulting reduction in wattage from 40 to 32 watts per tube.

Using \$10,000 in prize money the school received for its recycling efforts, Oak Grove has installed solar panels to provide electricity to two portable classrooms. Pacific Gas and Electric Company helped by installing a meter that allows the school district office to monitor the savings that result from the solar installation.

More recently, the administration has installed windows in some classrooms that provide better ventilation and reduce the use of air conditioning. Energy education has become part of the curriculum in every classroom, and students continue to be motivated to save energy and rely on natural ventilation and lighting.

## ***Pinole Valley High School***

### ***Pinole, California***

County:	Contra Costa
District:	West Contra Costa Unified
Grades:	9–12
Enrollment:	1,735
Population Status:	Urban fringe of a large city

Four seniors in the Environmental Studies Academy at Pinole Valley High School invested a lot of energy in saving energy at their school. The four students brought their special interest to bear through a club called the Watt Cops Energy Council, a club in which students met during lunch hours and prepared for energy patrols and other projects. The four seniors served as club mentors and officers, planning the meetings and working with a team of four or five juniors to carry out their projects.

Once a week, students in the academy received instruction about energy and energy efficiency, energy audits, marketing and advertising, and presentation skills. They used *Lighting in the Library*, a student workbook put together by the U.S. Department of Energy, to conduct lighting audits of the school library and cafeteria. With guidance from the head of maintenance of the West Contra Costa Unified School District, students used light meters to assess energy use. They counted fixtures, numbers and types of lamps, operating hours, and measured the total square footage of the library and cafeteria. They created spreadsheets to calculate current energy use and costs and analyzed the data to identify potential savings. They also researched ways to reduce greenhouse gas emissions and calculated payback times for different lighting retrofit options.

In addition, students in the environmental science class conducted audits related to heating systems. They calculated the volume of rooms to determine how many BTUs were required to maintain the rooms' heat at 69 degrees. They audited students in all classes and developed a proposal for a heating system retrofit using solar energy, which they brought to the school board. While they received strong support from the board, the plan was not approved because it did not involve all three high schools in the district. This setback hasn't stopped the students' work on the energy patrol observations.

The Watt Cops Energy Council has expanded its energy audits to local small businesses. With the support of Pinole's Redevelopment Agency, the students designed fliers to recruit business participants. They conducted audits of 15 local businesses, analyzing their data and developing comprehensive reports.

The local community is very interested in this work. The students have presented the findings from their audits and observations to the school board, the Pinole City Council, Rotary Club, and the Chamber of Commerce and at national, regional, and State conferences. Presenting to the city council helped students develop strong public speaking skills and articulate clearly, based on strong data, the reasoning behind their proposals.

This audit project evolved from a one-class effort, to the entire school, to the surrounding business community. The school district is committed to retrofitting the high school and the City of Pinole plans to retrofit its post office building in accordance with student recommendations.

The Environmental Studies Academy continues to do campus-based investigations and service-learning. In 2005, a group of students from the academy conducted the Green Schools' energy

audit on campus. Three of the participating students were selected to do summer internships and conduct energy audits in the community.

In addition to their work on energy conservation, the students of the Environmental Studies Academy have implemented a waste reduction program for the last six years. Academy students are responsible for the campus recycling program and, in 2005, won an award for their efforts from the West Contra Costa Waste Management Authority.

### ***Wawona Middle School***

#### ***Fresno, California***

<i>County:</i>	<i>Fresno</i>
<i>District:</i>	<i>Fresno Unified</i>
<i>Grades:</i>	<i>6–8</i>
<i>Enrollment:</i>	<i>853</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

Wawona Middle School in the Fresno Unified School District recently retrofitted the lighting in its 4,083-square-foot multi-purpose room. Wawona received support for this retrofit from the School Energy Efficiency (SEE) program. At the time, SEE was a program of the State and Consumer Services Agency, funded by the California Public Utilities Commission. This program, later operated by the California Integrated Waste Management Board, ended in December 2004.

SEE program partners such as Phillips (lamps), PowerLux (fixtures), and WattStopper (occupancy sensors) donated materials at no cost. WattStopper and Progressive Energy Management installed the equipment. In all, they replaced 72 recessed cans and incandescent lamps with ballasted recessed cans and compact fluorescent lamps. Additionally, they installed sensors that turn off the lights when a room is not occupied.

The retrofit was viewed as an opportunity to enhance the curriculum and integrate energy conservation into classroom learning. Students were involved in pre- and post-installation analysis of energy use and savings. The SEE team installed data loggers, which measure light and heat, one month before the installation and again one month after to track reduction in electricity use. The middle school students also kept journals about the lighting demonstration project, calculate energy savings based on information from the data loggers, and learned about energy and energy efficiency in their language arts and science classes. Using data obtained from the district office about past energy use, students charted monetary savings resulting from the retrofit.

As of June 2005, energy conservation is no longer part of the curriculum or actively tracked, but the energy-saving measures are still in place. The students estimated that the retrofit reduced energy consumption by almost 80 percent—20,000 kilowatts per year—and saves about \$3,400 on electricity bills.

# Energy and Air Resources:

## Section 2—Technical Support

---

### **Airhead**

[www.airhead.org/](http://www.airhead.org/)

Information about air pollution. Includes an emission calculator, emissions information, and ratings.

### **Alliance to Save Energy—Green Schools**

[www.ase.org/greenschools/about.htm](http://www.ase.org/greenschools/about.htm)

(202) 857-0666

Fee-based program helps schools assess and increase energy efficiency through changes in user behavior and operational and maintenance routines. Works with districts and schools. Offers teacher workshops and resources.

### **American Lung Association**

[www.lungusa.org](http://www.lungusa.org)

Information on health impacts of polluted air and clean air legislation.

### **Bicycle Federation of America**

[www.bikefed.org](http://www.bikefed.org)

Promotes community development for bicycling and walking. Includes a “safe routes to school” program.

### **Biodiversity and Your Energy Use**

#### **Center for Biodiversity and Conservation**

[www.research.amnh.org/biodiversity/center/living/Energy/index](http://www.research.amnh.org/biodiversity/center/living/Energy/index)

Background information linking biodiversity issues and energy use.

### **California Air Resources Board (Cal/EPA)**

[www.arb.ca.gov/](http://www.arb.ca.gov/)

Regulates sources of air pollution. Monitors select school sites to help determine adequacy of California’s air quality monitoring network to measure infant and child exposure to air pollutants. Studies of school bus and portable classroom air pollutant exposures. Maintains California Almanac of Emissions and Air Quality ([www.arb.ca.gov/aqd/almanac/almanac.htm](http://www.arb.ca.gov/aqd/almanac/almanac.htm)), which contains 20-year trend summaries of air quality and emissions data for 5 criteria pollutants and 10 toxic air contaminants. Straightforward but technical data. Air Pollution and What You Can Do web site ([www.arb.ca.gov/html/cando.htm](http://www.arb.ca.gov/html/cando.htm)) provides some background materials on air pollution problems and documents explaining bicycle awareness programs, indoor air quality, and a guide to buying cleaner cars. The California Air District Resource Directory ([www.arb.ca.gov/capcoa/roster.htm](http://www.arb.ca.gov/capcoa/roster.htm)) lists all 35 local air pollution control agencies in California and provides contact information and links to local websites.

### **California Department of Forestry and Fire Protection (Resources Agency)**

[www.fire.ca.gov/](http://www.fire.ca.gov/)

Urban and Community Forestry Program offers grants for school tree planting projects.

### **California Energy Commission (Resources Agency)**

[www.energy.ca.gov/](http://www.energy.ca.gov/)

Programs include the Bright Schools Program ([www.energy.ca.gov/efficiency/bright schools](http://www.energy.ca.gov/efficiency/bright_schools)), which offers specific services to help schools become more energy wise, such as identifying cost-effective, energy-efficient systems at little or no cost and provides technical support to eligible schools. The Solar Schools Program ([www.consumerenergycenter.org/solar\\_schools/program.html](http://www.consumerenergycenter.org/solar_schools/program.html)) offers schools rebates for installation of photovoltaic systems. Also includes links to energy-related websites ([www.energy.ca.gov/links](http://www.energy.ca.gov/links)).

### **California Energy Situation**

[www.eia.doe.gov/cneaf/electricity/california/california.html](http://www.eia.doe.gov/cneaf/electricity/california/california.html)

Federal site (U.S. Department of Energy). Background on California's energy crisis.

### **California Environmental Protection Agency (Cal/EPA)**

<http://www.calepa.ca.gov>

The California Environmental Protection Agency includes six boards, departments and offices that work on the protection of human health and the environment. Cal/EPA's mission is to restore, protect, and enhance the environment and to ensure public health, environmental quality, and economic vitality.

### **Collaborative for High Performing Schools (California)**

[www.chps.net/](http://www.chps.net/)

Best practices manual for building efficient school buildings in California. New construction and retrofitting.

### **Creating Safe Learning Zones: The ABC's of Healthy Schools Center for Health, Environment and Justice**

[www.chej.org/](http://www.chej.org/)

A guide to environmental health hazards at schools, including toxins found in schools and building materials, healthier alternatives in building materials, and indoor environments.

### **Data Logger**

[www.iscienceproject.com/](http://www.iscienceproject.com/)

Commercial product. Tool for measuring variables such as heat, temperature, and light. Logs data around the clock. Can be used to monitor usage. Logs data and produces easily interpreted graphs and charts.

### **The Energy Coalition**

[www.energycoalition.org](http://www.energycoalition.org)

A nonprofit organization dedicated to raising awareness among consumers, businesses, and municipalities about "smart energy management" strategies. Programs include the PEAK Student Energy Actions program, as well as networking and coalition-building opportunities.

### **Energy Information Administration**

[tonto.eia.doe.gov/ask/asknexpert.asp](http://tonto.eia.doe.gov/ask/asknexpert.asp)

An ask-an-expert opportunity.

**Energy Saving Strategies for Your School Eco-Response Team**

[www.mcps.k12.md.us/departments/sert/handbook.htm](http://www.mcps.k12.md.us/departments/sert/handbook.htm)

Designed for a program specific to Montgomery County Public Schools in Rockville, Maryland, but contains numerous energy conservation ideas for schools, many of which can be applied easily in California. Strategies address lighting, conservation in classrooms, computer use, kitchen, peak demand, and building services staff. Publication can be downloaded.

**EnergyStar Home Energy Advisor**

[advisor.lbl.gov/hit/Controller](http://advisor.lbl.gov/hit/Controller)

Do-it-yourself home energy audit tool. Calculates energy use and potential savings from EnergyStar appliances.

**Flex Your Power**

[www.flexyourpower.ca.gov/](http://www.flexyourpower.ca.gov/)

State of California website for energy-saving tips and incentives.

**Greenhouse Gas Calculator**

**United States Environmental Protection Agency**

[yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsGHGCalculator.html](http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsGHGCalculator.html)

An online calculator that estimates household greenhouse gas emissions. Suggests actions to reduce emissions.

**Indoor Air Quality Tools for Schools**

**U.S. Environmental Protection Agency Indoor Air Quality Division**

[www.epa.gov/iaq](http://www.epa.gov/iaq)

An action kit to prevent indoor air quality problems and resolve such problems if they do arise.

**Los Angeles Department of Water and Power**

**Cool Schools Program**

[www.ladwp.com/coolschools/pages/home.html](http://www.ladwp.com/coolschools/pages/home.html)

Partnership between Department of Water and Power and Los Angeles Unified School District and five nonprofit groups in the largest citywide, school-based community tree-planting program in Los Angeles history. Assistance with tree planting to increase energy efficiency.

**Metropolitan Water District of Southern California**

[www.mwd.dst.ca.us/](http://www.mwd.dst.ca.us/)

Publishes California water resources map describing local, State, and federal water projects. *Thinking More About Using Less* water and energy conservation program includes teacher guide, student materials, poster, and software to conduct home and school water-use and energy surveys.

**National Energy Education Development (NEED) Project**

[www.need.org](http://www.need.org)

Information on Solar Schools conference, grants, technical assistance, and online newsletter oriented to teachers.

**Pacific Gas and Electric**  
[www.pge.com/energenius](http://www.pge.com/energenius)

Specific information on PG&E systems. Curriculum links.

**Rebuild America**  
[www.rebuild.org/sectors/k12\\_resources.asp](http://www.rebuild.org/sectors/k12_resources.asp)

Information and publications, guidelines for high-performing schools and best practices.

**Schools Going Solar Project**  
**Interstate Renewal Energy Council**  
[irecusa.org/schools](http://irecusa.org/schools)

Networking among people with experiences with solar energy in schools. Resources, links, and tips for going solar in schools. Database of schools with solar programs.

**United States Department of Energy**  
[www.energy.gov/](http://www.energy.gov/)

Many programs and services. Energy Efficiency and Renewable Energy (EERE) program refers callers to the most appropriate EERE resources and allows them to submit questions about EERE resources electronically ([www.eere.energy.gov/informationcenter/](http://www.eere.energy.gov/informationcenter/)). Fact sheets on energy retrofitting ([www.eere.energy.gov/consumerinfo/factsheet.html](http://www.eere.energy.gov/consumerinfo/factsheet.html)). Energy Smart Schools ([www.eere.energy.gov/energysmartschools](http://www.eere.energy.gov/energysmartschools)) includes sections for administrators on building and maintaining schools, bus transportation. Also offers links for teachers and students. Some design guidelines for technical projects.

**United States Environmental Protection Agency**  
[www.epa.gov/](http://www.epa.gov/)

Extensive publications, links, education materials on all aspects of environment. Energy-related websites include Environmentally Preferable Purchasing Program ([www.epa.gov/opptintr/epp](http://www.epa.gov/opptintr/epp)), which includes downloadable information on purchase of appliances, cleaning products, office, supplies and more, ENERGY STAR Qualified Products ([www.energystar.gov/products](http://www.energystar.gov/products)), to help find energy-efficient products, and a Database of Environmental Information for Products and Services (<http://vosemite1.epa.gov/oppt/eppstand2.nsf>). An extensive Where You Live site ([www.epa.gov/epahome/whereyoulive.htm](http://www.epa.gov/epahome/whereyoulive.htm)) includes online environmental information about local communities, such as interactive maps, current forecasts, geographic statistics, and links to information on environmental issues like air and water quality, Superfund sites, and impaired water. Also links to local services working to protect your local environment. Search Your Community ([www.epa.gov/epahome/commsearch.htm](http://www.epa.gov/epahome/commsearch.htm)) enables searches by ZIP code to four extensive environmental databases. Ideas for service-learning projects on [www.epa.gov/teachers/community\\_service\\_projects.htm](http://www.epa.gov/teachers/community_service_projects.htm).

**Vending Miser**  
[www.bayviewtech.com/](http://www.bayviewtech.com/)

Commercial product. Motion sensor detectors to power down vending machines when no one is around. Provides data for monitoring energy output.

# Energy and Air Resources:

## Section 3—Student Survey

---

**Directions to the interviewer: Do not read the answers to the student. Just mark their answers on the sheet.**

We're taking a survey for our class. Can I ask you some questions?

What is your name? \_\_\_\_\_

What grade are you in? \_\_\_\_\_

**1. How is the electricity we use at our school created?**

- ☐ Hydroelectric generator.
- ☐ Coal-fired generator.
- ☐ Solar-electric panel.
- ☐ Nuclear generator.
- ☐ I don't know.

**2. On average, how comfortable is the temperature in your classroom?**

- ☐ Just right.
- ☐ Too cold.
- ☐ Too hot.

**3. Are lights in a classroom usually turned off when the last person leaves for a long period of time?**

- ☐ Yes. ☐ No. ☐ I don't know.

**4. A "renewable" resource is something that is replaceable by a natural cycle (in a reasonable period of time). Are oil and gasoline renewable?**

- ☐ Yes. ☐ No. ☐ I don't know.

**5. How did you get to school this morning?**

- ☐ Walked.
- ☐ Bike.
- ☐ Bus.
- ☐ Car.
- ☐ \_\_\_\_\_

**6. If by car, how many people were inside?**

\_\_\_\_\_

**7. When waiting after school, is the engine of the bus or car you ride home in running?**

- ☐ Yes. ☐ No.  
☐ I don't know. ☐ Does not apply.

**8. How will you get home this afternoon?**

- ☐ Walk.
- ☐ Bike.
- ☐ Bus.
- ☐ Car.
- ☐ \_\_\_\_\_

**9. Are there any benefits to reducing the number of cars that drive to and from school?**

- ☐ Yes. ☐ No. ☐ I don't know.

**10. If yes, what are they?**

*Directions to the interviewer: Check all answers given.*

- ☐ Cost savings.
- ☐ Gasoline savings.
- ☐ Reduced air pollution.
- ☐ Less chance of car accident.
- ☐ Personal health through exercise.
- ☐ \_\_\_\_\_

**Thank you for your time.**



# Water Resources:

## Section 1—Case Studies

---

### ***The Athenian School***

#### ***Danville, California***

<i>County:</i>	<i>Contra Costa</i>
<i>District:</i>	<i>San Ramon Valley Unified</i>
<i>Grades:</i>	<i>6–12</i>
<i>Enrollment:</i>	<i>512</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

The Athenian School is a private preparatory school (grades 6–12) at the base of Mt. Diablo, about an hour's drive east of San Francisco. Environmental conservation is one of the five pillars of the school. Community service, both on- and off-campus, is considered an important component of the curriculum.

Each year, students in the twelfth grade environmental science classes work to identify environmental problems on campus, propose solutions, present those solutions to the school's board of trustees, and plan and implement several of the projects that result from this process. Once a project is approved, the students have the responsibility for planning and making decisions. To date, the students have saved the school roughly \$20,000 per year.

The 2001 environmental science classes consulted with outside experts, including the East Bay Municipal Utility District, and conducted a detailed and extensive water audit for their campus. They identified key water uses in various areas, observed wasteful practices and facilities, and studied how best to potentially conserve water in each area. Through their audit, the students assessed the public restrooms, kitchen, dorms, faculty housing, the swimming pool, and landscape irrigation.

With the assistance of their expert consultants, the students discerned that Athenian was wasting 1,150 gallons of water per day from leaky faucets and toilets in the restrooms. They assessed the flow rates of different sinks in the kitchen and recognized that those sinks not used for filling large pots could be restricted to lower flow rates. They also found leaking toilets, faucets, and showers in their dorms. With the cooperation of their teachers, they discovered wasteful flow rates in the faculty homes on campus. Wasted water wasn't confined to the buildings; their data showed that water use for landscaping and irrigation was excessive and that not covering the school pool during the summer resulted in evaporation and the need for refilling.

The team discovered that the school's landscaping irrigation system accounted for over half the water use on campus for much of the year. Sprinkler systems were in such disrepair that their efficiency could not even be tested for uniformity of water distribution.

The students worked with faculty to install low-flow devices in the faculty housing village, repaired leaks and installed appropriate low-flow devices throughout the school. They suggested behavioral changes in the kitchen and worked to repair and improve landscaping systems, including planting with drought-tolerant plants.

To date, these water-saving efforts remain in place. Initial estimates by the students indicate that their actions save 6,500 gallons of water and \$371 per day.

## **California School for the Deaf**

### **Fremont, California**

*County:* Alameda  
*District:* State Special School  
*Grades:* K–12  
*Enrollment:* 451  
*Population Status:* Urban fringe of a large city

Students at the California School for the Deaf in Fremont have included several water-saving measures in the design and development of their new environmental farm.

The pumps and filter for the fish pond and waterfall are self-circulating and powered by solar panels installed atop the renovated greenhouse, which was designed and built by the school's construction technology class. They use a water-conserving drip system for irrigation. Gutters around the greenhouse gravity-feed water into 55-gallon drums for the gardens, which produce fruit, organic vegetables, herbs, and decorative plants. Merritt College volunteers helped develop a water-conserving native plant garden, including a hummingbird and butterfly garden. The students established a pumpkin hill, where they hope to grow the world's largest pumpkin. (Their 2004 gourd weighed in at 550 pounds!) In summer 2005, they are installing a solar-powered pond—complete with turtles, fish, frogs, and water plants—for use as an educational venue by the campus' elementary school students.

The School for the Deaf is installing a computer system to regulate water quality and provide data for humidity and temperature control.

## **Dover Elementary School**

### **San Pablo, California**

*County:* Contra Costa  
*District:* West Contra Costa Unified  
*Grades:* K–5  
*Enrollment:* 663  
*Population Status:* Urban fringe of a large city

One hundred students at Dover Elementary School in San Pablo addressed water conservation and water quality concerns by removing 1,900 square feet of water-hungry sod and replacing it with a "Habitat Garden." The garden is planted with drought-tolerant native plants. Heavily mulching the garden with hay keeps weeds down, prevents soil erosion, and reduces evaporation.

To protect the water quality of two nearby creeks, the students never apply pesticides or fertilizers. Instead, the students make use of integrated pest management practices with native plants to attract beneficial insects, birds, and other wildlife that naturally control pest species. They use recycled compost from the West Contra Costa Waste Management Authority to build up the health of the soil. These young gardeners participate in the county's green waste program by recycling the weeds that sprout daily.

Dover's fifth graders used the Internet to research California native plants and determine which plants to add to their garden. They wrote paragraphs about each plant, describing the plant size,

flower color, bloom time, plant community, wildlife benefit, and medicinal qualities. The students also created a simple field guide to help visitors identify plants as they come into bloom and explain the wildlife benefits of each species.

During field trips to nearby parks and open spaces, the students demonstrated their knowledge of wildflowers and learned the importance of protecting biodiversity, wildlife habitat and open spaces. They also explored ways to protect the creeks in their community, concern for which played a big part in the decision to use integrated pest management in their garden.

The fifth graders established a monitoring program and now compare the water quality in nearby Wildcat Creek to that of their classroom. They shared their results through the school and at district science fairs.

To promote the use of water-saving and beneficial plants at home, the students established a drought tolerant demonstration garden within the Habitat Garden. The school plans to sell native plants to the community and use the money to publicize the importance of protecting waterways through integrated pest management, use of drought tolerant plants and creation of wildlife habitat. The students plan to create “How You Can Help Wildcat Creek” door hangers to distribute to homes throughout their neighborhoods.

Working closely with the fourth- and second-grade classes, the fifth-grade students developed leadership skills as they planted and cared for the Habitat Garden. The younger students took on the task of raising and releasing butterflies in the garden. The water quality and garden programs at Dover Nearly have involved nearly 800 students.

### ***Monte Vista Elementary School***

#### ***Santa Barbara, California***

<i>County:</i>	<i>Santa Barbara</i>
<i>District:</i>	<i>Hope Elementary</i>
<i>Grades:</i>	<i>K–6</i>
<i>Enrollment:</i>	<i>496</i>
<i>Population Status:</i>	<i>Mid size city</i>

In drought-conscious Santa Barbara, teachers and students at Monte Vista Elementary School have worked with many community partners to conserve water in their gardens. Recognized as a California Distinguished School and a National Blue Ribbon School, Monte Vista employs a strong garden-based curriculum. Drought tolerant native plants have replaced traditional landscaping in a half-acre nature trail area. The school uses mulching and composting to reduce water waste. While water-saving drip irrigation is in place in the native plant nature, it seldom needs to be used.

Community volunteers including master gardeners, the local organic gardening club, high school students fulfilling community-service requirements, and college interns have all played a part in building and maintaining the school’s pesticide-free native plant gardens, butterfly habitat, vegetable and herb gardens, mini farmers market, and recycling and vermicomposting stations.

The proceeds from the first farmer’s market were used to purchase the equipment needed for the school’s salad bar, now served three days per week. Now funds raised are used for a range of environmental and nutrition-based environmental projects. Volunteer parents run the market in front of the school for 2½ hours every Thursday. They sell lemonade, fresh produce, flowers,

seeds, plants, healthy snacks and hand-made craft items, most of which are donated. Some of the items are grown and made by students at school.

## ***Oak Grove Elementary School***

### ***Graton, California***

<i>County:</i>	<i>Sonoma</i>
<i>District:</i>	<i>Oak Grove Union Elementary</i>
<i>Grades:</i>	<i>K–5</i>
<i>Enrollment:</i>	<i>263</i>
<i>Population Status:</i>	<i>Urban fringe of a mid-size city</i>

Oak Grove School is located in rural Sonoma County on a 5-acre parcel. Originally established in 1854, the current buildings were constructed in 1954. The school community has made a commitment to “use all things entrusted to us with care, not to use more than we need, and to pass on to the future everything that we can.”

To save water, Oak Grove replaced much of its lawn area with drought-tolerant landscaping and gardens. In addition to xeriscaping, each classroom maintains its own garden and the school maintains a vegetable garden that supplies low-cost produce for the school salad bar. They recently planted fruit and nut trees, which will begin contributing to the salad bar in a few years. In 2005, they added herb gardens and edible flowers to enhance the salads. Compost from the school’s vermicomposting system is used to enrich the soil in classroom and school gardens and landscaped areas.

The school no longer uses any herbicides or pesticides in its landscape maintenance, thus preventing potentially dangerous chemicals from entering the water system. To protect the watershed further, the school received a grant to involve its fifth-graders in an effort to mitigate runoff from Oak Grove School into nearby Atascadero Creek. Students measured the square footage of rooftops and asphalt surfaces to determine the amount of water flowing off-campus. They then determined how much water flows to the soccer field and how much enters storm drains.

Recent mitigation efforts have included development of a catchment area to help retain water on campus, adding underground gravel and sod in slow-draining vegetated areas to reduce pooling, and building structures in the bus lanes that divert water along gravel pathways into the gardens. These pathways reduce runoff and retard seepage into the ground. Students have helped to dig the gardens, plant vegetation and build the structures. The custodial staff has also installed rain barrels to catch water which they use for irrigation.

Students worked with the local watershed council to stencil drains on- and off-campus. They continued their community education efforts by participating in a community creek clean-up project in 2004 and helping to plant trees.

## ***Salmon Creek School***

### ***Occidental, California***

*County:* Sonoma  
*District:* Harmony Union Elementary  
*Grades:* 5–8  
*Enrollment:* 170  
*Population Status:* Rural area (metropolitan)

Watershed protection is central to Salmon Creek School's Environmental Education and Watershed Restoration Program. Located on 63 acres of diverse wilderness with a creek, a recovering redwood forest, a wetlands area, and a grassy flatland, the school is in the early stages of a major habitat renovation that will serve as a regional model for its academic approach as well as its ecological restoration efforts.

Some of the elements of the project include: students learning to design and implement a water quality study and watershed mapping protocol; contributing their data to the Global Rivers Environmental Education Network Web site; preparing displays and presentations for the annual community Watershed Day; developing a site management plan (with two local restoration experts); and establishing a native plant nursery for future grassland and creekside restoration.

As part of the curriculum associated with the project, students will study water conservation issues, uses of water and ways to conserve water. They will learn to conduct a campus water audit and present conservation recommendations to the school administration.

Groups from neighboring Roseland School District have now visited the site to explore how they might use Salmon Creek as a model for their own campus. Salmon Creek students intend to visit Roseland to compare and contrast environmental problems in the two watersheds.

Salmon Creek School is uniquely situated to link service-learning on the traditional campus and in the local watershed to forge a deep connection between water quality and quantity issues and preservation of natural habitats.

## ***San Francisco Community Alternative School***

### ***San Francisco, California***

*County:* San Francisco  
*District:* San Francisco Unified  
*Grades:* K–8  
*Enrollment:* 303  
*Population Status:* Large city

The transformation of the San Francisco Community School's asphalt yard into a vibrant outdoor learning environment is the "Green Dreams" dream come true. An alternative school in the San Francisco Unified School District, the school emphasizes service-learning. A side benefit of the school's desire to create a natural setting for learning is the reduction of runoff and water pollution from the school's asphalt yard.

The first step in the project was obtaining a planning grant from the San Francisco Urban Resources Partnership to create a master plan. In 1999, students, staff and parents organized “Green Dreams,” a team charged with researching and developing the new schoolyard. Members of the group visited other sites to explore possibilities. The entire student body attended a slide show and looked at photographs showing what their schoolyard might look like. The students conducted a survey, developed by Green Dreams members, and then tallied and graphed the data. They presented their results at a design workshop in November 1999.

Green Dreams vision for the schoolyard combined a park and garden with such features as vegetable and flower gardens, fruit trees, sand and water play areas, natural climbing structures, endangered species and native habitat restoration, and outdoor classrooms for meetings, art, and music.

Groundbreaking took place on April 14, 2000, and during spring break, a heavy equipment crew removed the remaining asphalt from the soon-to-be garden areas. Students planted seeds, painted planter boxes, added a greenhouse donated by The Garden Project at the San Francisco County Jail, and sold plants at a December Project Night fundraiser.

Since that time, they have added features such as a butterfly garden, a worm bin, solar earth ovens, a peace mural, and fence. As with the entire school curriculum (San Francisco Community Alternative School is a science-themed, project-based learning school), these projects were fully integrated into the curriculum, and students were involved from the start in planning, developing, and implementing their designs.

In one study unit, older students used the garden area and the remaining asphalt to provide a comparative context for watershed studies and experiments regarding runoff in urban and natural areas. This living schoolyard continues as an integral part of every school day.

## ***South Tahoe High School***

### ***South Lake Tahoe, California***

<i>County:</i>	<i>El Dorado</i>
<i>District:</i>	<i>Lake Tahoe Unified</i>
<i>Grades:</i>	<i>9–12</i>
<i>Enrollment:</i>	<i>1,540</i>
<i>Population Status:</i>	<i>Urban fringe of a large city</i>

Runoff from the school parking lot flowed down a slope and into a drainage ditch, causing a significant erosion problem at South Tahoe High School in South Lake Tahoe. This water eventually drains, untreated, into Lake Tahoe, where water quality is already compromised with high sediment loads, increased nitrogen and phosphorus levels, and algal blooms.

Students in one of six environmental studies classes at the school used soil testing kits to determine soil chemistry, and elementary-level science kits on landforms to study erosion. Once given this background, the students were asked what was wrong with the current holding pond set-up and how they might fix it.

The high school students explored options and decided that the soil needed ground cover and mulch to protect it from erosion and diminish water pollution. In addition, mulch would help prevent water loss from evaporation. The students formed working groups, came up with

proposals for solving the problems, presented them to the principal, and got approval for their plans.

By choosing to focus on native plants, the students further reduced dependence on watering. They researched native plants and worked with the Tahoe Resource Conservation District, which donated seeds. Staff of the Lahonton Water Quality District volunteered many hours of assistance. The Tahoe Regional Planning Agency, Homeland Landscaping, the University of Nevada, U.C. Extension, and a local nursery all partnered with the students and donated expertise, plants and services. South Lake Tahoe Refuse donated dump trucks full of pine needles for mulch to reduce soil erosion and conserve water. They also donated nylon netting to prevent erosion, but the students learned that animals could get caught in the netting and now recommend against using it.

Students evaluated the success of their project by measuring the number of runoff-induced rills produced from the holding pond. Their data show that their work has significantly reduced erosion from the campus and the related water pollution.

Another environmental studies class chose to reduce water use and attract wildlife by converting existing landscaping to water-conserving native plants. The students sought input from other classes and staff and decided what species to plant. Working with the district's landscaping experts and California State Parks botanists, they mapped out and replanted ten plots of land.

The school's ROP (Regional Occupational Program) class worked on water irrigation and conducted a water audit. The students learned to measure, triangulate, and convert inches to metric. The wood shop classes made benches with donated wood. By involving others, the original team of students helped to create ownership and build support for their campus projects.

To date, the program remains in place. Currently, the students are conducting a tree thinning program to ensure forest health; campus water runoff continues to be diverted away from the drainage ditch into mitigation ponds developed during construction of the school's Science and Technology wing. South Tahoe High School continues to offer an environmental science class as well as an Advanced Placement environmental science class through which students undertake environmental service-learning projects on campus.

## ***Tenaya Middle School***

### ***Fresno, California***

<i>County:</i>	<i>Fresno</i>
<i>District:</i>	<i>Fresno Unified</i>
<i>Grades:</i>	<i>7–8</i>
<i>Enrollment:</i>	<i>1,029</i>
<i>Population Status:</i>	<i>Large city</i>

What is the quantity of water entering Tenaya Middle School during a calendar year? What is the source and quality of that water? Is there a change in water quantity use during different billing periods? How much is used and in what locations? Are there places on campus where water is lost due to leaks? If so, how much is lost?

Students at Tenaya Middle School found the answers to these questions and more through research, consultation with local experts, analysis of billing data, development of a water use

map, interviews with faculty, staff, and administrators, and a tour of a local Public Utilities Department Pumping Station.

Once they identified the locations of water sources, students developed week-long surveys to place in the restrooms and near drinking fountains. The surveys helped them ascertain the average use of toilets, urinals, sinks, and fountains. They also gave the surveys to teachers to determine classroom water use for labs, cleanup and drinking. Students calculated the amount of water used in each washing machine cycle. They even timed how long it takes to get a drink of water, and measured the rate of flow to figure total consumption at the school's drinking fountains.

Tenaya Middle Schoolers didn't leave out the food services department. They interviewed kitchen staff and determined how much water was used in cooking, clean-up, and even how much went through the Hobart dishwasher each cycle.

After extensive data collection, the seventh- and eighth-graders drew correlations between human activities, water consumption, and water lost due to leaks. Their research indicated that Tenaya was losing 70,160 gallons per year of water to leakage.

The students reported their data to the principal, the Superintendent of Fresno Unified School District and the Fresno City Public Utilities Water Conservation Department. Within five days, workers were at the school to repair leaks the facilities supervisor had complained about for years. The outcome gave the students great satisfaction; and the feeling that their scientific study had real meaning.



# Water Resources:

## Section 2—Technical Support

---

### **American Water Works Association**

[www.awwa.org/](http://www.awwa.org/)

List of water utilities.

### **California Department of Pesticide Regulation (Cal/EPA)**

[www.cdpr.ca.gov/](http://www.cdpr.ca.gov/)

Regulates the registration, sale, and use of pesticides. Educational materials are targeted to school administrators and facilities managers. Publications include *School Pest Management*, comprehensive information about voluntary school integrated pest management programs, Suppliers of Beneficial Organisms in North America, and Consumer Fact Sheets, which include “How to Read a Pesticide Label.”

### **California Department of Water Resources (Resources Agency)**

[www.dwr.water.ca.gov/](http://www.dwr.water.ca.gov/)

Office of Water Use Efficiency ([www.owue.water.ca.gov/](http://www.owue.water.ca.gov/)) deals with leak detection, demonstration projects and data analysis to achieve water use efficiency. It provides loans and grants to make more efficient use of water and energy resources.

### **California Environmental Protection Agency (Cal/EPA)**

[www.calepa.ca.gov](http://www.calepa.ca.gov)

The California Environmental Protection Agency includes six boards, departments and offices that work on the protection of human health and the environment. Cal/EPA’s mission is to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality.

### **California Urban Water Conservation Council**

[www.cuwcc.org/](http://www.cuwcc.org/)

List of water utility members.

### **East Bay Municipal Utility District**

[www.ebmud.com/](http://www.ebmud.com/)

Utility district provides industrial, commercial, and institutional audits of domestic, sanitary, process, and landscape water use. Free water-efficient devices provided if need is determined. Also offers home audits.

### **H<sub>2</sub>OUSE Water Saver House Tour**

[www.h2ouse.org/](http://www.h2ouse.org/)

Virtual house tour shows potential water savings in a typical house. Written for consumers but has application to schools (faucets, landscaping, bathrooms). A program of the California Urban Water Conservation Council.

**Office of Environmental Health Hazard Assessment (Cal/EPA)**

[www.oehha.ca.gov/](http://www.oehha.ca.gov/)

Responsible for developing toxicological and medical information relevant to public health and providing it to State and local government agencies. Assesses health risks that chemicals in the environment may pose to humans. Technical information.

**State Water Resources Control Board (Cal/EPA)**

[www.swrcb.ca.gov/](http://www.swrcb.ca.gov/)

Has materials focusing on watershed stewardship and monitoring. Clean Water Team Citizen Monitoring Program ([www.swrcb.ca.gov/nps/volunteer.html](http://www.swrcb.ca.gov/nps/volunteer.html)) has statewide coordinators to help support citizen monitoring to reduce and prevent water pollution. Stormwater Program ([www.swrcb.ca.gov/stormwtr/pollution\\_prevention.html](http://www.swrcb.ca.gov/stormwtr/pollution_prevention.html)) provides technical information on stormwater pollution prevention.

**United States Environmental Protection Agency**

[www.epa.gov/](http://www.epa.gov/)

Extensive publications, links, education materials on all aspects of environment. An extensive Where You Live section ([www.epa.gov/epahome/whereyoulive.htm](http://www.epa.gov/epahome/whereyoulive.htm)) includes online environmental information about local communities, such as interactive maps, current forecasts, geographic statistics, and links to information on environmental issues like air and water quality, Superfund sites, and impaired water. Also links to local services working to protect your local environment. Search Your Community ([www.epa.gov/epahome/commsearch.htm](http://www.epa.gov/epahome/commsearch.htm)) enables searches by zip code to four extensive environmental databases. Includes profiles of local watershed. Also includes Watershed Indicators ([www.epa.gov/wateratlas/geo/maplist.html](http://www.epa.gov/wateratlas/geo/maplist.html)) with national maps showing urban and agricultural runoff potential and other watershed indicators. Ideas for service-learning projects on [www.epa.gov/teachers/community\\_service\\_projects.htm](http://www.epa.gov/teachers/community_service_projects.htm).

**United States Geological Survey**

<http://water.usgs.gov>

Background information on water and water issues, access to data, national water quality assessment program.

**Wastewater Demonstration**

[www.wef.org/education](http://www.wef.org/education)

Interactive graphic model shows how wastewater is treated once it leaves the home.

**WaterWiser, The Water Efficiency Clearinghouse****American Water Works Association**

[www.awwa.org/waterwiser/](http://www.awwa.org/waterwiser/)

Includes a database of existing water conservation education programs in the United States and case studies to show how some of these programs are being implemented in various locations. Also offers links to education materials and a drip calculator where you enter drip rate data and the calculator returns rate of water waste ([www.awwa.org/advocacy/learn/conserve/dripcalc.cfm](http://www.awwa.org/advocacy/learn/conserve/dripcalc.cfm)).

# Water Resources:

## Section 3—Student Survey

---

**Directions to the interviewer. Do not read the answers to the student. Just mark their answers on the sheet.**

We're taking a survey for our class. May I ask you some questions?

What is your name? \_\_\_\_\_

What grade are you in? \_\_\_\_\_

**1. Where is the most water used at school?**

- ☐ Bathrooms.
- ☐ Cafeteria.
- ☐ Grounds (to water grass).
- ☐ \_\_\_\_\_

**2. What kinds of pollution could leak from a car onto the ground?**

- ☐ Battery acid.
- ☐ Radiator fluid/coolant.
- ☐ Motor oil.
- ☐ Gasoline.
- ☐ \_\_\_\_\_

**3. Where does the water that runs off the school end up?**

- ☐ Soaks into the ground.
- ☐ Drains to ocean.
- ☐ Evaporates into the sky.
- ☐ Drains to a water treatment center.
- ☐ \_\_\_\_\_

**4. Do you always turn off the water in the bathroom sink when you're done using it?**

- ☐ Always.
- ☐ Usually.
- ☐ Sometimes.
- ☐ Never.

**5. Do you let the water in the drinking fountain run to cool it?**

- ☐ Always.
- ☐ Usually.
- ☐ Sometimes.
- ☐ Never.

**6. If a toilet in the school restroom is stuck flushing, what do you do?**

- ☐ Try to fix it.
- ☐ Tell the janitor.
- ☐ Tell someone in the office.
- ☐ Nothing.

**7. Does water going down a sink or toilet go to the same place that the water in the gutter does?**

- ☐ Yes. ☐ No. ☐ I don't know.

**8. Where does the water going down the drain or toilet go?**

- ☐ Septic tank or system.
- ☐ Water treatment plant.
- ☐ Streams, rivers, ocean.
- ☐ \_\_\_\_\_

**9. Where does the water going down the gutter go?**

- ☐ Septic tank or system.
- ☐ Water treatment plant.
- ☐ Streams, rivers, ocean.
- ☐ \_\_\_\_\_

**Thank you for your time.**